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ABSTRACT

A meta-analysis was performed to synthesize existing research on the effect of gender differences on attitudes toward computers. A total of 106 studies were located from three sources, and their quantitative data were transformed into Effect Size. Nine variables were selected for coding: nationality of subjects, population group, sample size, type of publication, year of publication, reliability of measure, statistical power, statistics, and type of attitude. The results suggest that male subjects had slightly higher (more positive) attitudes toward computers than female subjects. While many authors have indicated that women and girls are more likely to hold lower attitudes toward computers than males, the results of this study provide accumulated research-based evidence to support this hypothesis. Left unanswered is the question of what factors truly contribute to the differences. Studies of this question will require further clarification of the exact relationship between gender and computer learning. This meta-analysis points out only that gender differences on attitudes toward computers exist. (Contains 31 references.) (Author/AEF)

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GENDER DIFFERENCES ON ATTITUDES TOWARD COMPUTERS: A META-ANALYSIS

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Abstract: A meta-analysis was performed to synthesize existing research of gender differences on attitudes toward computers. One hundred and six studies were located from three sources, and their quantitative data were transformed into Effect Size (ES). The overall grand mean of the study-weighted ES for all 106 studies was 0.19. The results suggest that male subjects had slightly higher attitudes toward computer female subjects. While many authors have indicated that women and girls are more likely to hold lower attitudes toward computers (e.g., Jagodzinksi & Clarke, 1986), the results of this study provide an accumulated research-based evidence to support this hypothesis. Left unanswered is the question of what factors truly contribute to the differences. Studies of this question will require further clarification of the exact relationship between gender and computer learning. This meta-analysis points out only that gender differences on attitudes toward computers exist.

Computer attitudes usually refer to people's reactions to computers. These reactions include liking about, confidence to use, belief about the usefulness of, sex stereotype of, and ability stereotype of computers. As computers have been increasingly used in our society, many studies have reported people's attitudes toward computers (e.g., Campbell, 1992; Chu & Spires, 1991; Gordon, 1993; Kay, 1993; Whitley, 1996). In particular, much research effort has gone into looking at gender differences and their causes on computer attitudes (e.g., Blumer, 1987; Campbell, 1988; 1989; Chen, 1986; Koohang, 1989; Loyd & Gressard, 1986; Meier, 1988; Wallace & Sinclair, 1995; Woodrow, 1994). This issue is critical since the U.S Department of Labor had predicted that by 1995 at least 2 million people would be in occupations related to computers and millions of others would be using computers as part of their jobs (Armitage, 1993). Nowadays, it is reasonable to believe that the number of people who need to use computers to fulfill their job requirements is much more than in 1995.

Computer use has been portrayed in our society as more appropriate to men and boys than women and girls (Whitley, 1997). Computer games and educational software have been designed to appeal more to boys than girls (Kiesler, Sproull, & Eccles, 1985). Computer use in schools has also been linked to traditionally 'masculine' subjects such as science and mathematics but not to traditionally 'feminine' subjects such as art and literature (Hawkins, 1985). These gender differences in socialization have led to the hypothesis that women and girls are more likely to hold more negative attitudes toward computers.

Although many studies have been conducted on this hypothesis (Blumer, 1987; Campbell, 1988; 1989; Chen, 1986; Koohang, 1989; Loyd & Gressard, 1986; Meier, 1988; Wallace & Sinclair, 1995; Woodrow, 1994), the results of existing studies have reported a confusing picture. For example, Campbell (1990), Chen (1986), Colley, Gale, & Harris (1994), Jacobson (1991), Loyd & Gressard (1986), Wallace & Sinclair (1995), Whitley (1996a;1996b), and Woodrow (1994) all reported significantly higher computer attitudes for males than females, while Blumer (1987), Campbell (1986;1989), Cantrell (1995), Chu & Spires (1991), Francis (1994), Koohang (1987;1989), Loyd & Gressard (1985), Loyd, Loyd, & Gressard (1987), Mertens & Wong (1988), Pope-Davis & Twing, and Robertson, Calder, & Jones (1995) have indicated that there is little, if any, differences of computer attitudes between males and females. Owing to the mixed evidence provided by existing research in the area, this study attempts to use the meta-analytic approach to investigate the gender differences on attitudes toward computers. The results from this meta-analysis will help provide clearer conclusion.

PROCEDURES

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The research method used in this study is the meta-analytic approach which was similar to that described by Glass, McGaw, & Smith (1981). The studies considered for use in this meta-analysis came from three major sources and were published from 1984 to 1997. One large group of studies came from computer searches of Education Resources Information Center (ERIC). A second group of studies came from Comprehensive Dissertation Abstracts. A third group of studies was retrieved by branching from bibliographies in the documents located through review and computer searches. One hundred and six studies were located through these search procedures; 19 studies came from ERIC and conference proceedings, 80 studies were retrieved from published journals, 7 studies were from Comprehensive Dissertation Abstracts..

Several criteria were established for inclusion of studies in the present analysis.

1. Studies had to assess the differences between males and females on computer attitudes.
2. Studies had to provide quantitative results from both male and female subjects.
3. Studies had to be retrievable from university or college libraries by interlibrary loan or from ERIC, Dissertation Abstracts International, or University Microfiche International.

There were also several criteria for eliminating studies or reports cited by other reviews: (a) studies did not report sufficient quantitative data in order to estimate Effect Sizes; (b) studies reported only correlation coefficients -- r value or Chi-square value; (c) studies could not be obtained through interlibrary loans or from standard clearinghouses.

Outcome Measures

The outcome measured most often in the selected studies was survey data from participants, as indicated in various instruments for examining participants' computer attitudes. For statistical analysis, outcomes from a variety of different studies with a variety of different instruments had to be expressed on a common scale. The transformation used for this purpose is the one recommended by Glass et al. (1981). To reduce measurements to a common scale, Glass and his colleagues coded each outcome as an Effect Size (ES), defined as the difference between the mean scores of two groups divided by the standard deviation of the control group. For those studies that did not report means and standard deviations, F, or t, values were used for estimating the ES.

In most cases, the application of the formula given by Glass and his colleagues was quite straightforward. But in some cases, when more than one value was available for use in the formula of ES, the value, which measured outcomes most correctly, was selected. For example, some studies reported both differences on pretest measures and differences in posttest measures. In such cases, pretest measures were selected for estimating ES so that any treatment which may change participants' general feelings about computers could be avoided.

In other cases, several subscales and subgroups were used in measuring a single outcome (e.g., those that reported separate data by ethnicity or grade). In such cases, each comparison was weighted in inverse proportion to the number of comparisons within the study (i.e., 1/n, where n = number of comparisons in the study) so that the overweighing of ES of a study could be avoided (see, for example, Waxman, Wang, Anderson, & Walberg, 1985, p. 230).

Variables Studied

Nine variables were selected for coding each study in the present synthesis. These variables are listed in Table 1. The first 2 variables were coded so that potential different effects for subjects with different background could be detected. The following 2 variables (i.e., type of publication and year of publication) were coded because it is important to know how effects are related to sources of information over time. The next 4 variables were coded so that effects related to characteristics of research design could be detected. The last variable was coded because it is critical to know how effects are associated with different types of attitudes. Each variable was employed as a factor in an analysis of variance (ANOVA) to investigate whether there were significant differences within each variable on the effect size.

Variables

Nation of Subject
Population Group
Type of Publication
Year of Publication

Sample Size
Reliability of Measure
Statistical Power
Statistics
Type of Attitude

Table 1. Coded Variables for the Meta-analysis

RESULTS

Of the 106 studies included in the present synthesis, 85 or 80% of the study-weighted ESs were positive and favored the male subjects, while 21 or 20% of them were negative and favored the female subjects, indicating that males had lower computer anxiety than females. The range of the study-weighted ESs was from -0.85 to 0.881. The overall grand mean for all 106 study-weighted ESs was 0.192. When this mean ES was converted to percentiles, the percentiles on computer attitudes were 58 for the male subjects and 50 for the female subjects. The standard deviation of 0.286 reflects the small variability of ESs across studies.

Among the 489 ESs included in the present synthesis, 363 or 74% were positive and favored the male subjects, while 121 or 25% were negative and favored the female subjects. Only 1 or 1% of the ESs indicated no difference between male and female subjects. The range of the ESs was from -0.85 to 0.881.

Table 2 lists the F values for the 9 variables for all study-weighted ESs in the study. Descriptive statistics for the 9 variables are presented in Table 3. The positive means for liking, belief/usefulness, confidence, and mixed indicate more positive attitudes favor male subjects; however, for sex stereotype and ability stereotype, the positive means indicate a higher sex and ability stereotype for male subjects.

For ANOVA, 1 variable, type of attitude, showed statistically significant impact. The post hoc test for type of attitude, ($F(6,232) = 2.554$, $P<.05$), showed that the mean comparison of studies that measured sex stereotype was significantly higher than studies that measured liking, anxiety, belief/usefulness, confidence, ability stereotype and mixed attitudes. In addition, the mean comparison of studies that measured belief was significantly higher than studies that measured mixed attitudes.

Variables	*df*	*F*	*p*
Nation of Subject[a]	1, 108	1.964	0.164
Population Group[a]	4, 111	0.684	0.605
Sample Size	3, 102	0.588	0.624
Type of Publication	2, 103	0.859	0.427
Year of Publication	4, 101	1.094	0.364
Reliability of Measure	2, 103	0.509	0.603
Statistical Power	2, 103	0.070	0.932
Statistics	2, 103	1.742	0.180
Type of Attitude[a]	6, 232	2.554	0.021*

p<.05
Note. a Some studies reported more than one comparison groups.

Table 2. Results of ANOVAs for Coded Variables

Variables	N	%	ES	SD

Nation of Subject[a]				
USA	86	78.2	0.205	0.296
Non-USA	24	21.8	0.114	0.219
Population Group[a]				
K – Elementary	7	6.2	0.181	0.347
Secondary	27	21.2	0.141	0.303
College	50	44.2	0.221	0.254
Teacher & Adult	17	15.0	0.109	0.301
Mixed	15	13.3	0.162	0.257
Sample Size				
Less than 200	35	33.0	0.207	0.398
201 – 400	38	35.8	0.178	0.227
401 – 1000	23	21.7	0.235	0.216
Over 1000	10	9.4	0.098	0.126
Type of Publication				
Journal article	80	75.5	0.172	0.291
Dissertation/thesis	7	6.6	0.288	0.277
ERIC & Conference	19	17.9	0.241	0.269
Year of Publication				
1983 – 1985	10	9.4	0.142	0.269
1986 – 1988	29	27.4	0.208	0.265
1989 – 1991	20	18.9	0.09	0.351
1992 – 1994	26	24.5	0.216	0.252
1995 – 1997	21	19.8	0.262	0.294
Reliability of Measure				
Actual reliability figure	85	80.2	0.188	0.262
Adequate indication	4	3.8	0.333	0.607
Unspecified or inadequate	17	16.0	0.178	0.322
Statistical Power				
Adequately minimized	85	80.2	0.195	0.235
Probably threat	20	18.9	0.187	0.457
Inadequate or Unspecified	1	0.9	0.089	0.000
Statistics				
Mean & Standard deviation	77	72.6	0.166	0.303
t - value	8	7.5	0.172	0.213
F - value	21	19.8	0.296	0.227
Type of Attitude[a]				
Anxiety	42	17.6	0.096	0.226
Belief/Usefulness	31	13.0	0.020	0.100
Confidence	53	22.2	0.088	0.124
Liking	49	20.5	0.070	0.094
Ability-related Stereotype	6	2.5	-0.030	0.115
Sex-related Stereotype	20	8.4	0.193	0.277
Mixed	38	15.9	0.105	0.235

Note. a Some studies reported more than one comparison groups.

Table 3. Means and Standard Deviations of Study-weighted ES for Coded Variables

DISCUSSION

The results of this meta-analysis indicate that, overall, male subjects had slightly higher computer attitudes than female subjects. An effect is said to be small when ES = 0.2, medium when ES = 0.5 and large when ES = 0.8 (Cohen, 1977). Eighty percent of positive study-weighted ES values and 74% of positive ESs

overall also confirm the gender differences on computer attitudes. The slightness of the differences must be keep in mind, however; the overall study-weighted mean ES of 0.192 only indicates 8 percentile scores higher than the female subjects. The percentile scores for the overall grand mean and median were identical, reflecting the small variability of ESs across studies.

The significant differences found among the mean comparison of studies that measured sex stereotype and studies that measured liking, anxiety, belief/usefulness, confidence, ability stereotype and mixed attitudes were quite interesting. It is possible because male subjects hold higher sex-related stereotype toward computer use, and this tendency influences female subjects' feelings about computers that results in females' overall more negative attitudes toward computers. In short, the gender differences on sex-related stereotype toward computer use may be the key factor that yields the gender differences on overall attitudes toward computers. More studies need to be addressed on this hypothesis.

CONCLUSION

Although many studies have been conducted to examine the hypothesis that women and girls are more likely to hold more negative attitudes toward computers (Blumer, 1987; Campbell, 1988; 1989; Chen, 1986; Koohang, 1989; Loyd & Gressard, 1986; Meier, 1988; Wallace & Sinclair, 1995; Woodrow, 1994), and still fail to get a clearer picture, the results of this study provide an accumulated research-based evidence to support this hypothesis. Left unanswered is the question of what factors truly contribute to the differences. Studies of this question will require further clarification of the exact characteristics of each type of computer attitude (e.g., anxiety, confidence, and sex-related stereotype) and their relationships with gender. This meta-analysis points out only that gender differences on attitudes toward computers exist. That information by itself is useful.

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